Revision

1.0.0



RK-433-RC
USER'S MANUAL

RADIOTRONIX, INC.

RK-433-RC USER'S MANUAL

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1

1. Description

The RK-433-RC is a rapid-development/evaluation kit for the Radiotronix family of 433 MHz transmitter and receiver modules. The kit is designed to allow engineers a fast wireless keyless entry and remote control development solution for integration into their applications.

1.1. Transmitter SecureFOBs™

The kit comes with two different SecureFOB™ key fobs that allow for fast evaluation of the Radiotronix 433 MHz transmitter modules. Each SecureFOB™ has 3ea buttons that will correspond to 3ea relays on the receiver board. The SecureFOB™ features a rolling code encoder, Microchip HCS300 that provides secure transmission. Please refer to Microchip's datasheet for more information on this part. Each SecureKob™ has an on board loop antenna that is tuned for optimal performance. The SecureFOB™ runs off of a 3.0V lithium coin cell (CR2032) battery for long life.

Note: RCT-433-UTR and RCR-433-ASBR modules, the transmitting components core to the SecureFOB™ are capable of operating at 2-12 V supply voltage. Additional range performance can be obtained by modifying the SecureFOB™ design within the limits of the various local regulatory rules.

Please visit http://www.radiotronix.com for more information on these transmitter modules.

- KFB-433-TX1-R (SecureFOB™ featuring the RCT-433-UTR "ultra tiny" transmitter module)
- KFB-433-TX2-R (SecureFOB™ featuring the RCT-433-ASBR "tiny" transmitter module)

1.2. Receiver Modules

The Multi-Receiver Unit (MRU) development board allows for the evaluation of each version of the Radiotronix 433 MHz receiver modules. The Multi-Receiver Units (MRU) can support all Radiotronix remote control receiver modules:

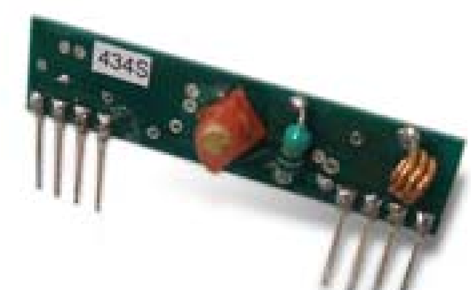
Included in the kit are:

- 2 – Transmitter SecureFOB™
    - One KFB-433-TX1-UTR (RCT-433-UTR transmitter module inside)
    - One KFB-433-TX2-ASBR (RCT-433-ASBR transmitter module inside)
- 4 – Receiver Modules
    - One RCR-433-RPR (Low Cost Super-Regen Receiver Module)
    - One RCR-433-HPR (High Sensitivity Super-Het Receiver Module)
    - One RCR-433-MPR (Low Cost Super-Regen Receiver Module)

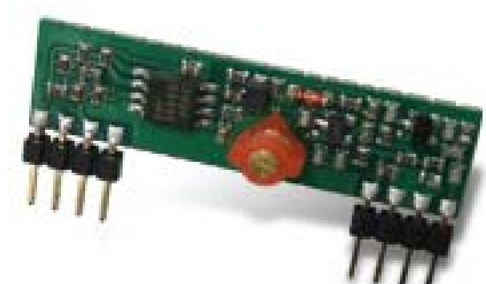
- One RCR-433-EPR (High Sensitivity Super-Het Receiver Module)
- 1 – Receiver Evaluation Board
- 1 – Right Angle, Reverse Polarity, 433MHz Helical Antenna
- 1 – 9 V/ 450 mA Power Supply
- CD, contains Kit User's Manual and related Datasheets

*** Datasheets/ User's Manuals may be found on the Radiotronix website (http://www.radiotronix.com).**

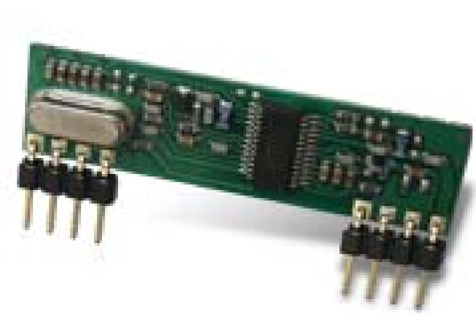
1.2.1. Receiver Module Identification



RCR-433-RPR



RCR-433-MPR



RCR-433-EPR



RCR-433-HPR

Figure 1: Receiver Module Identification

Chapter

2

2. RK-433-RC Development Kit Setup

Before operating your RK-433-RC development kit for the first time, initial setup must be completed.

2.1. Hardware Setup

Please refer to Figures 2 and 3 for assistance with the following.

- Plug **only one** receiver module into its proper socket in the receiver evaluation board. The sockets are labeled in the PCB silkscreen.
- Ensure the jumpers on JP1 matches the voltage rating of a selected receiver (3V or 5V). The following table lists the correct jumper setting for each module.

Receiver Module Type	Voltage Setting
RCR-433-RPR	5V
RCR-433-HPR	5V
RCR-433-MPR	5V
RCR-433-EPR	5V
RCR-433-HPR-3V	3V

Table 1, Voltage Settings for Receivers

- **Make sure to populate only one receiver at a time.**
- Apply power to the receiver by plugging in the 9V power supply to the Multi-Receiver Unit (MRU) power jack.
- Install one CR2032 coin cell battery to each SecureFOB™. Use a coin to pry open the plastic case at the seam. Insert coin cell with flat (positive +) side towards the metal clip. Place PCB back into plastic housing and snap back together.

2.2. SecureFOB™ / Receiver Learning

The SecureFOBs™ and receiver evaluation board utilize KEELOQ™ encoder (HCS300) and decoder (HCS512) hardware from Microchip Inc. These rolling-code coders implement a proprietary algorithm that provides a high level of security to the transmission.

The SecureFOBs™ included in the kit should already be "learned" to the receiver evaluation board. If a new KEELOQ™-based receiver is introduced, a learning process must be completed, pairing a transmitter with a

receiver. The receiver may learn up to three transmitters. Please refer to figures 1 and 2 for the instructions below.

1) On the receiver evaluation board, push the SW1 Learn button. The DS5 LED should light up.

2) Press any of the three buttons on the transmitter (once). On the Multi-Receiver Unit (MRU) evaluation board, DS5 LED should turn off.

3) On the transmitter, press any of the three buttons again (once). The DS5 led should flash for five seconds on the Multi-Receiver Unit (MRU) evaluation board.

If done correctly, the transmitter SecureFOB™ is now paired with the Multi-Receiver Unit (MRU).

Note: The learning process is independent of the module used. Receiver modules may be interchanged without affecting the learning process. The transmitters and the receiver board should already be learned and functional at initial startup.

Chapter

3

3. Development Kit Operation

The Multi-Receiver Unit (MCU) receiver evaluation board, once equipped with a receiver, will receive signals from learned SecureFOBs™. Out of the box, the development kit SecureFOBs™ are learned to the Multi-Receiver Unit (MCU) evaluation board. When a SecureFOB™ button is pressed, an LED and relay are toggled. The following table shows the relationship between the SecureFOB™ button and the receiver LEDs and relays.

BUTTON	LED	RELAY
Button 1	DS2	K1
Button 2	DS3	K2
Button 3	DS4	K3

Table 2, Button, LED, and Relay Correspondence

3.1. Low Battery (LED)

Additionally, the Multi-Receiver Unit (MRU) evaluation board features a "low battery" led indication for the active SecureFOB™. While the SecureFOB™ is transmitting, DS1 (led) will illuminate if the battery in the SecureFOB™ is in need of replacement.

Devices may be attached to the relay outputs of the evaluation board. The screw-terminal connectors are pluggable and may be attached to a variety of circuits. The ratings of the relays used on the Multi-Receiver Unit (MRU) evaluation board are listed at the end of this document and must not be exceeded.

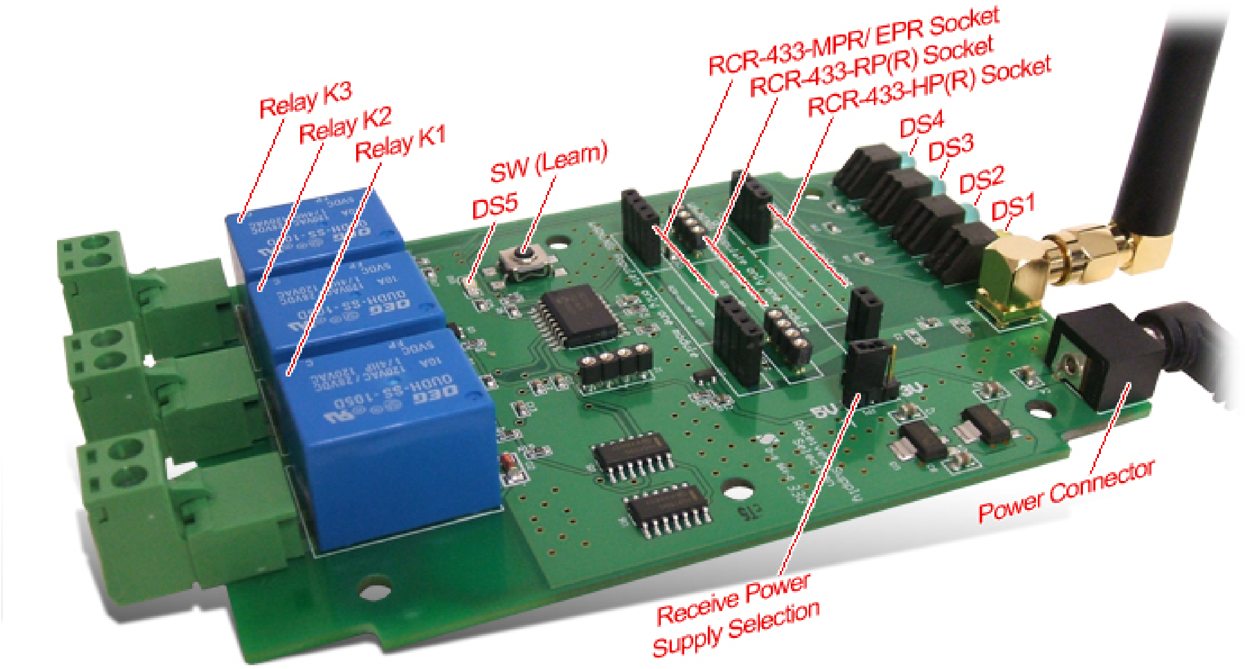


Figure 2: Multi-Receiver Unit (MRU) Evaluation Board

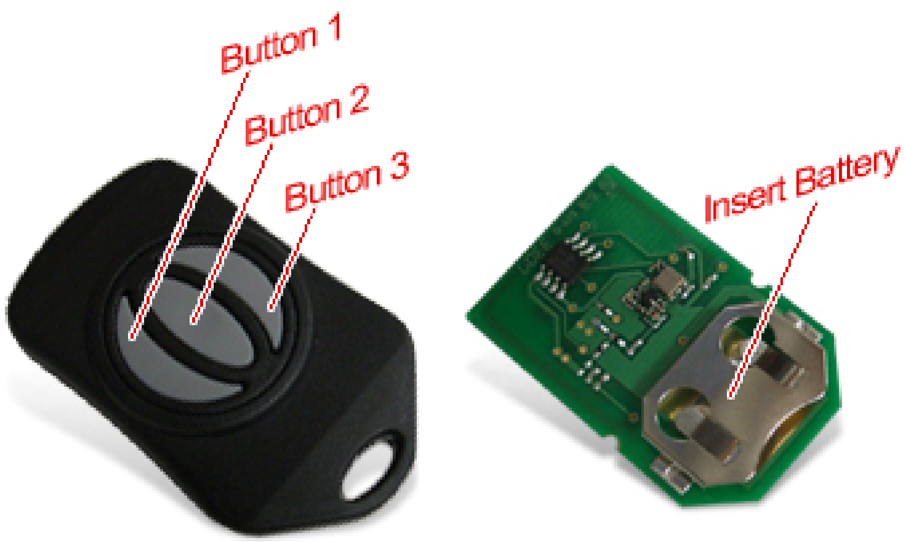


Figure 3: Button Identification and Battery Insert

Chapter 4

4. Electrical Specifications

Parameter RCT	MIN	MAX	UNITS
Power Supply	2	12	VDC
Battery, SecureFOB™	2	3	VDC
Storage Temperature	-50	100	^{O}C
Operating Temperature (ASBR versions)	20	70	^{O}C
Operating Temperature (UTR versions)	-40	75	^{O}C

Table 3, Electrical Specifications for RCT-433-UTR/ RCT-433-ASBR

Note: SecureFOB's™ set up to operate at 3.0V with lithium coin cell batteries included.

Parameter RCR	MIN	MAX	UNITS
Power Supply	6	12 V/ 500 mA	VDC
Relay Input Voltage (DC)		28 V @ 10 A	VDC
Relay Input Voltage (AC)		120 V @ 10 A	VAC

Table 4, Electrical Specifications for Multi-Receiver Unit (MRU)

4.1. Detailed Electrical Specifications

4.1.1. RCT-433-UTR Detailed Electrical Specifications

Parameter (General)	Symbol	Min	Typ	Max	Units	Notes
Operating Voltage	V_{CC}	3.0		12	Volts DC	
Modulation			ASK/ OOK			
Power Consumption		8	10	12	mA	@ 12V
Frequency Accuracy	TOL_{fc}	-120		+120	kHz	
Center Frequency	F_C		433		MHz	RCT-433-UTR
Output Power		9	10	12	dBm	@ 12V/ Data: 3V
Data Rate		1		3	kHz	

Table 5, RCT-433-UTR Detailed Electrical Specifications

4.1.2. RCT-433-ASBR Detailed Electrical Specifications

Parameter (General)	Symbol	Min	Typ	Max	Units	Notes
Operating Voltage	V_{CC}	1.5	3.0	12	Volts DC	
Operating Current Data = VCC	I_{CC}		4.5		mA	@ 3V
Operating Current Data = GND	I_{CC}		100		uA	@ 3V
Frequency Accuracy	TOL_{fc}	-75	0	+75	KHz	@ 3V
Center Frequency	F_C		433		MHz	RCT-433-ASBR
Output Power			0		dBm	@ 3V
Baud Rate - NRZ		DC		480 0	BPS	

Table 6, RCT-433-ASBR Detailed Electrical Specifications

4.1.3. RCR-433-HPR Detailed Electrical Specifications

Parameter (General)	Symbol	Min	Typ	Max	Units
Operating Voltage	V_{CC}	4.5	5.0	5.5	Volts DC
Operating Current Data = VCC	I_{CC}		4.5		mA
Reception Bandwidth	BW_{rx}		150		kHz
Center Frequency	F_C		433		MHz
Sensitivity			-109		dBm
Baud Rate – NRZ		1200		4800	BPS
Baud Rate – PWM		120		2400	BPS
Audio Bandwidth	BW_{audio}	.15		2.8	kHz
Selectivity			TBD		TBD
Operating Temperature	T_{op}	-20		+70	°C

Table 7, RCR-433-HPR Detailed Electrical Specifications

4.1.4. RCR-433-RPR Detailed Electrical Specifications

Parameter (General)	Symbol	Min	Typ	Max	Units
Operating Voltage	V_{CC}	4.5	5.0	5.5	Volts DC
Operating Current Data = VCC	I_{CC}		4.5		mA
Reception Bandwidth	BW_{rx}		3.0		kHz
Center Frequency	F_C		433		MHz
Sensitivity			-102		dBm
Baud Rate – NRZ		1200		4800	BPS
Baud Rate – PWM		120		2400	BPS
Audio Bandwidth	BW_{audio}	.15		2.8	kHz
Selectivity			TBD		TBD
Operating Temperature	T_{op}	-20		+70	°C

Table 8, RCR-433-RPR Detailed Electrical Specifications

4.1.5. RCR-433-HPR3V Detailed Electrical Specifications

Parameter (General)	Symbol	Min	Typ	Max	Units
Operating Voltage	V_{CC}	3.0	3.3	3.6	Volts DC
Operating Current Data = VCC	I_{CC}		5.8	6.88	mA
Reception Bandwidth	BW_{rx}		150		kHz
Center Frequency	F_C		433		MHz
Sensitivity			-109		dBm
Baud Rate – NRZ		1200		4800	BPS
Baud Rate – PWM		120		2400	BPS
Audio Bandwidth	BW_{audio}	.15		2.8	kHz
Selectivity			TBD		TBD
Operating Temperature	T_{op}	-20		+70	°C

Table 9, RCR-433-HPR3V Detailed Electrical Specifications

4.1.6. RCR-433-MPR Detailed Electrical Specifications

Parameter (General)	Symbol	Min	Typ	Max	Units
Operating Voltage	V_{CC}	4.75	5.0	5.25	Volts DC
Operating Current Data = VCC	I_{CC}		4	5	mA
Reception Bandwidth	BW_{rx}		150		kHz
Center Frequency	F_C		433		MHz
Sensitivity			-105		dBm
Baud Rate – NRZ		1200		4800	BPS
Baud Rate – PWM		120		2400	BPS
Audio Bandwidth	BW_{audio}	.15		2.8	kHz
Selectivity			TBD		TBD
Operating Temperature	T_{op}	-40		+85	°C

Table 10, RCR-433-MPR Detailed Electrical Specifications

4.1.7. RCR-433-EPR Detailed Electrical Specifications

Parameter (General)	Symbol	Min	Typ	Max	Units
Operating Voltage	V_{CC}	4.75	5.0	5.25	Volts DC
Operating Current Data = VCC	I_{CC}		2	3	mA
Reception Bandwidth	BW_{rx}		150		kHz
Center Frequency	F_C		433		MHz
Sensitivity			-109		dBm
Baud Rate – NRZ		1200		4800	BPS
Baud Rate – PWM		120		2400	BPS
Audio Bandwidth	BW_{audio}	.15		2.8	kHz
Selectivity			TBD		TBD
Operating Temperature	T_{op}	-40		+85	°C

Table 11, RCR-433-EPR Detailed Electrical Specifications

4.2. Absolute Maximum Ratings

4.2.1. AC Specifications- Tx

Parameter	MIN	MAX	UNITS
Vdd- Power Supply	2	15	VDC
Storage Temperature	-40	+85	^{o}C

Table 12, Absolute Maximum Ratings for SecureFOBs

4.2.2. AC Specifications- Rx

Parameter	MIN	MAX	UNITS
Vdd- Power Supply	2	15	VDC
Storage Temperature	-40	+85	^{o}C

Table 13, Absolute Maximum Ratings for Multi-Receiver Unit (MRU)

Note: Refer to the specific transmitter or receiver datasheet for more detailed information.

Chapter

5

5. PCB Layout Diagrams

5.1. Multi-Receiver Unit (MRU) Evaluation Board Layout

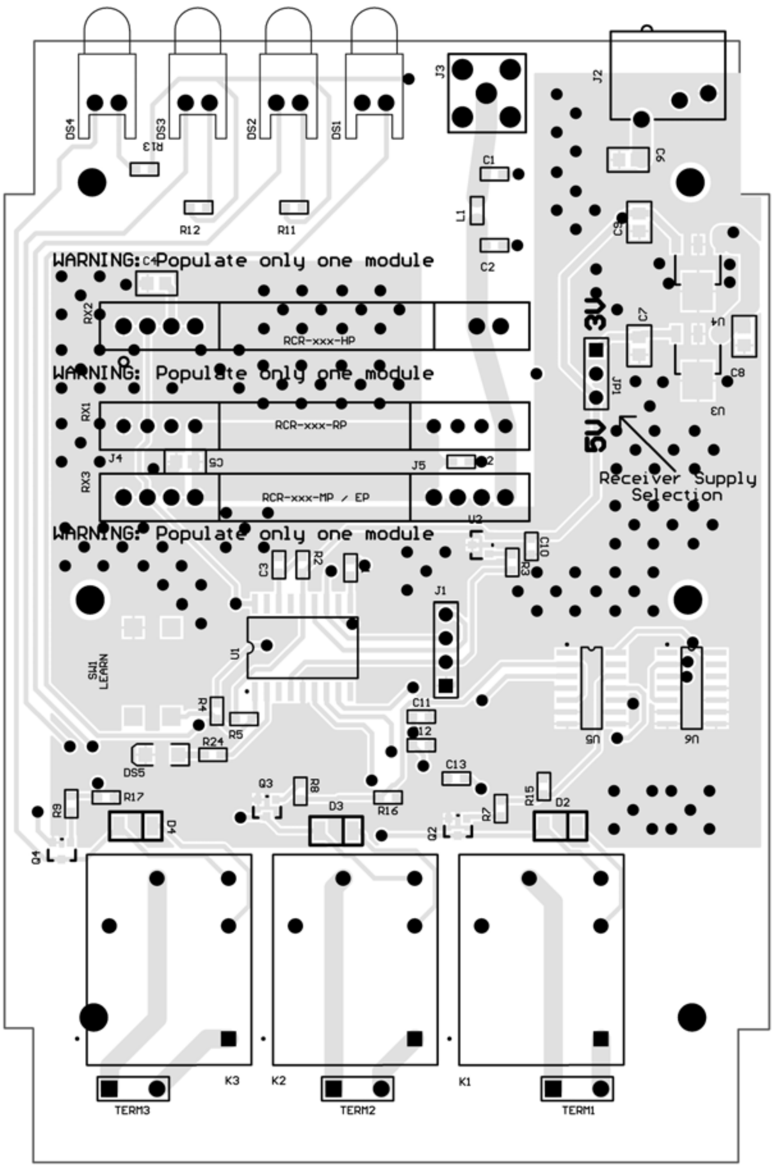


Figure 4: Multi-Receiver Unit (MRU) Board Layout

5.2. SecureFOB™ (KFB-433-TX1-UTR) Board Layout

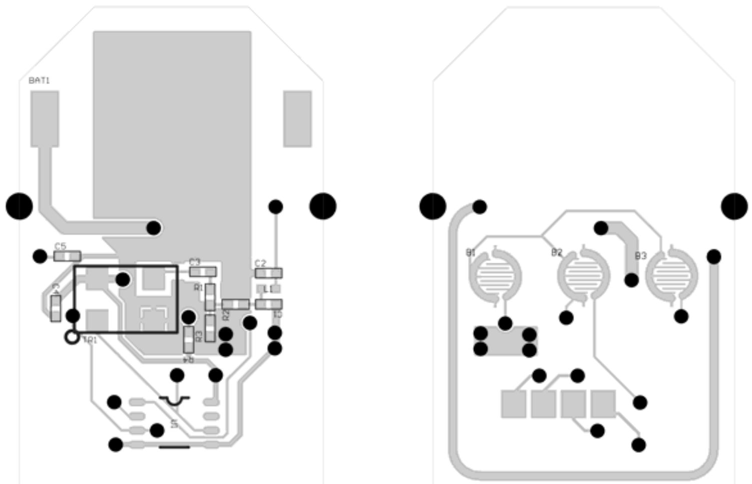


Figure 5: SecureFOB™ (KFB-433-TX1-UTR) Board Layout

5.3. SecureFOB™ (KFB-433-TX2-ASBR) Board Layout

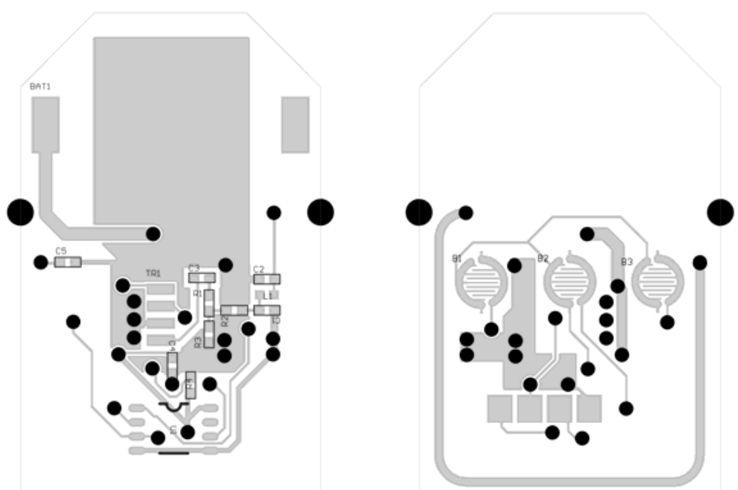


Figure 6: SecureFOB™ (KFB-433-TX2-ASBR) Board Layout

Chapter

6

6. Schematic Diagrams

6.1. Multi-Receiver Unit (MRU) Schematic Diagram

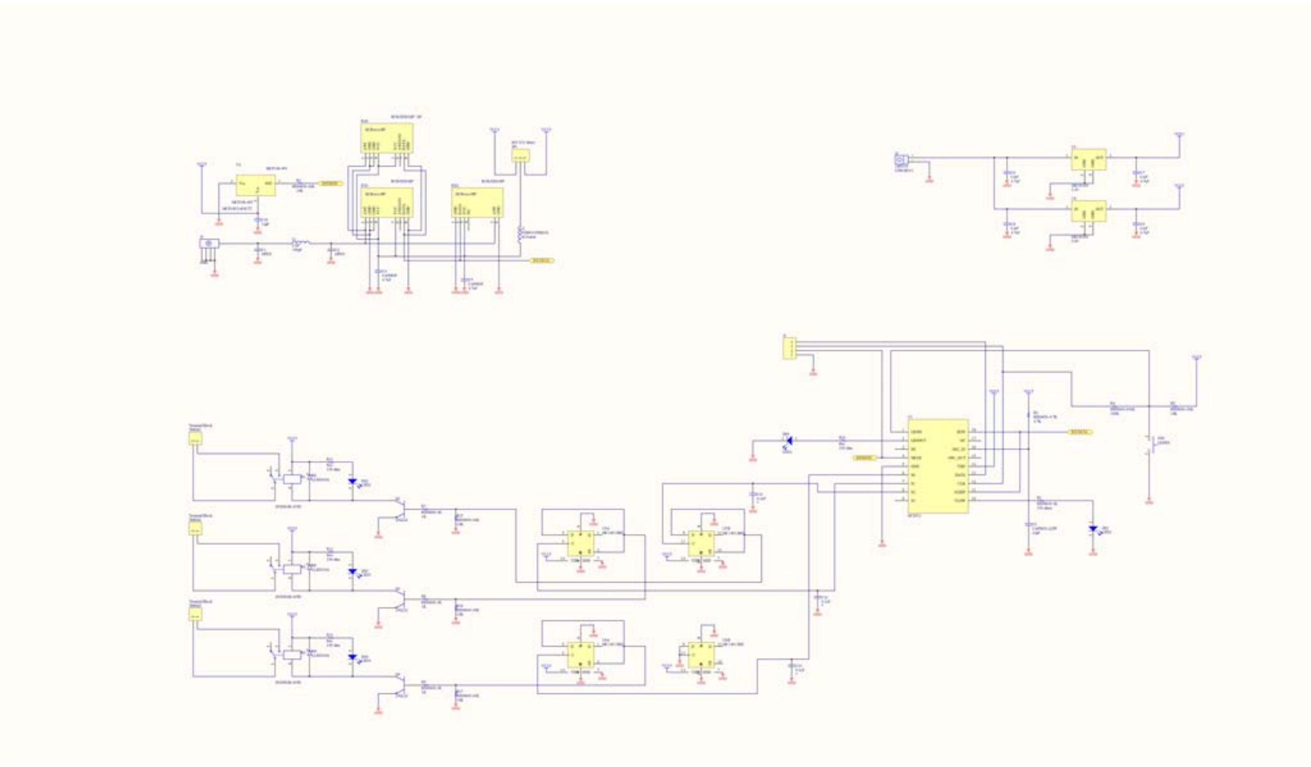


Figure 7: Multi-Receiver Unit (MRU) Schematic Diagram

6.2. SecureFOB™ (KFB-433-TX1-UTR) Schematic Diagram

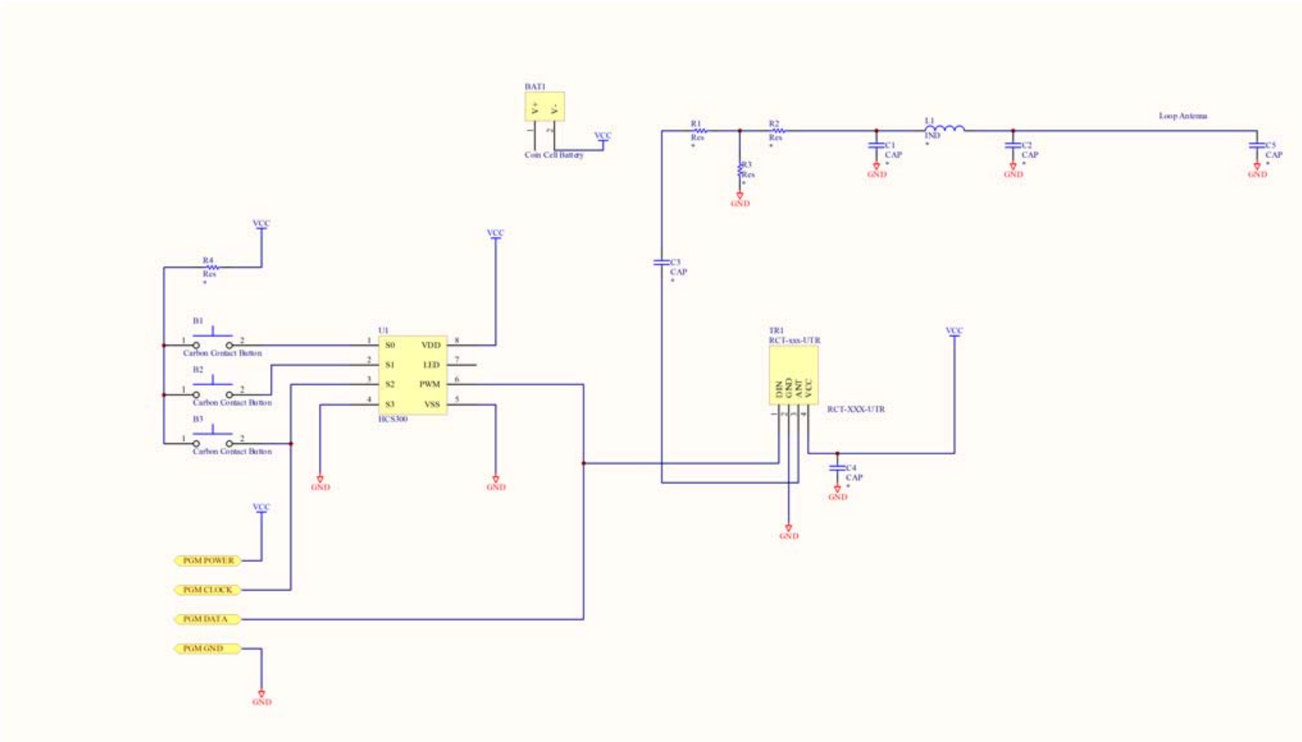


Figure 8: SecureFOB™ (KFB-433-TX1-UTR) Schematic Diagram

6.3. SecureFOB™ (KFB-433-TX2-ASBR) Schematic Diagram

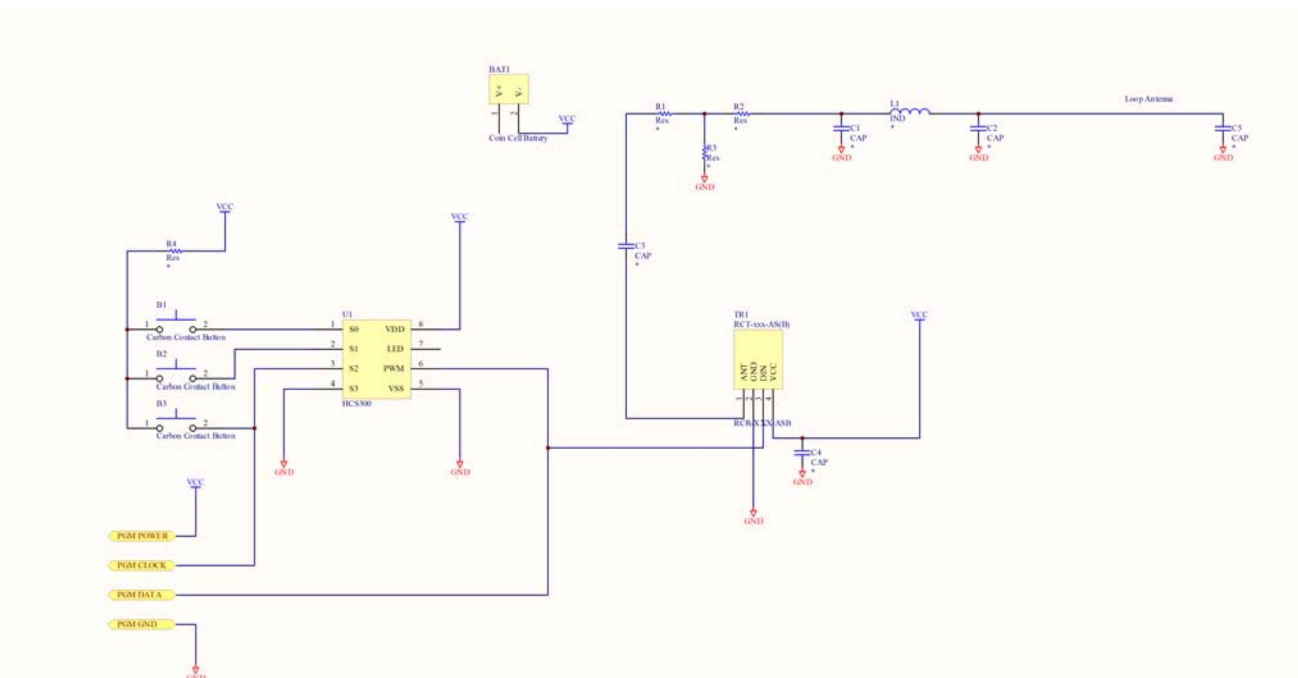


Figure 9: SecureFOB™ (KFB-433-TX2-ASBR) Schematic Diagram

Chapter

7

7. Custom Applications

Radiotronix can custom-tailor existing products, or design complete turnkey systems for volume customers. For more information on these services, please contact Radiotronix at (405) 794-7730.

7.1. Design Files Availability

Radiotronix is offering this product as a development tool for customers wishing to lay out their own boards or customize this existing design for remote control applications using the Radiotronix transmitter modules and receiver modules or build the ex. A design package is available through Radiotronix Sales that will consist of the Gerber's, BOM and Schematics. Please contact Radiotronix for more information.

Chapter

8

8. Ordering Information

Product Part Number	Description
RK-433-RC	433 MHz Development Kit

8.1. Contact Information

Corporate Headquarters:
905 Messenger Lane
Moore, Oklahoma 73160
405-794-7730
website: www.radiotronix.com
support: support@radiotronix.com

8.1.1. Technical Support

Radiotronix has built a solid technical support infrastructure so that you can get answers to your questions when you need them. Our primary technical support tools are the support forum and knowledge base found on our website. We are continuously updating these tools. To find the latest information about these technical support tools, please visit http://www.radiotronix.com/support. Our technical support engineers are available Mon-Fri between 9:00 am and 5:00 pm central standard time. The best way to reach a technical support engineer is to submit a Webcase. Webcase submissions can be made at http://www.radiotronix.com/support/webcase.asp. For customers that would prefer to talk directly to a support engineer, we do offer phone support free of charge.

8.1.2. Sales Support

Our sales department can be reached via e-mail at sales@radiotronix.com or by phone at 405-794-7730. Our sales department is available Mon-Fri between 8:30 am and 5:00 pm central standard time. Visit our web site at http://www.radiotronix.com/corpsales.asp for information on where to buy our products.